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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|------------------------------|-------------|----------------------|---------------------|------------------|
| 10/692,578 | 10/24/2003 | Se-Ho Lee | 5649-1194 | 9027 |
| 20792 | 7590 | 05/23/2005 | EXAMINER | |
| MYERS BIGEL SIBLEY & SAJOVEC | | | PHAM, LONG | |
| PO BOX 37428 | | | ART UNIT | PAPER NUMBER |
| RALEIGH, NC 27627 | | | 2814 | |

DATE MAILED: 05/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | |
|------------------------------|------------------------|---------------------|
| Office Action Summary | Application No. | Applicant(s) |
| | 10/692,578 | LEE, SE-HO |
| | Examiner | Art Unit |
| | Long Pham | 2814 |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on _____.
- 2a) This action is **FINAL**. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-10 and 24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-3,5,7-10 and 24 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 24 October 2003 is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

| | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of claims 1-10 and 24 in the reply filed on 03/25/05 is acknowledged.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1, 2, 3, 5, 7, 8, 9, 10, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over the applicant's admitted prior art (AAPA) of this application in combination with Sugaya (US patent 6,844,268).

With respect to claims 1 and 24, AAPA teaches a structure in a phase changeable memory cell, comprising (see figs. 1-3 and associated text of this application):

a bottom electrode 12 having interlayer dielectric layer 14 thereon; and a phase changeable layer 18 over the dielectric layer and the bottom electrode.

however, AAPA fails to teach that the bottom electrode having a recess and the phase changeable layer is formed in the recess.

Sugaya teaches a similar structure in a memory cell in which a bottom electrode 48 having recess, a dielectric layer is formed in the recess of the bottom electrode, and a upper electrode is formed over the dielectric layer. See fig. 10I and associated text.

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It would have been obvious to one of ordinary skill in the art of making semiconductor devices to incorporate Sugaya's teaching into the AAPA's structure to improve write and erase characteristics of the memory cell. See col. 14, lines 35-40.

Further with respect to claim 24, AAPA teaches the phase changeable layer 18 is electrically connected to the bottom electrode 12 with a contact formed in a contact hole through the interlayer dielectric layer but fails to teach the changeable layer is directly connected to the bottom electrode without the use of contact.

However, it would have been obvious to one of ordinary skill in the art of making semiconductor devices to form the phase changeable layer in the contact hole to directly connect to the bottom electrode without the use of the contact to eliminate the step of forming the contact hole.

With respect to claim 2, Sugaya fails to teach the depth for the recess in the bottom electrode.

However, it would have been obvious to one of ordinary skill in the art of making semiconductor devices to determine the workable or optimal value or range for the depth of the recess through routine experimentation and optimization to obtain optimal or desired device performance because the depth of the recess is a result-effective variable and there is no evidence indicating that it is critical or produces any unexpected results and it has been held that it is not inventive to discover the optimum or workable ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

With respect to claim 3, AAPA further teaches the interlayer dielectric layer includes a contact hole.

With respect to claim 5, AAPA in combination with Sugaya teach a memory cell including a bottom electrode disposed over a substrate, an interlayer dielectric layer formed over the substrate having a bottom electrode, a data storage element

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16,18 extended through the interlayer dielectric layer to connect the bottom electrodes, the storage element is extended into the bottom electrode to a depth so that a portion of the sidewall of the storage element is in contact with the bottom electrode.

AAPA and Sugaya fail to teach forming a plurality of memory cell.

However, the formation of plurality of same memory cell to form an array of memory cells is well-known.

With respect to claim 7, the formation of a bottom electrode through a lower interlayer dielectric layer formed on a substrate to contact the substrate is well-known in the art.

With respect to claims 8 and 10, the use of Titanium nitride as electrode material is well-known.

With respect to claim 9, A APA further teaches a phase changeable pattern electrically connected 18 with the bottom electrode 12 and an upper electrode formed on the phase changeable pattern.

Allowable Subject Matter

4. Claims 4 and 6 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Long Pham whose telephone number is 571-272-1714. The examiner can normally be reached on M-F, 7:30AM-3:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 571-272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Long Pham
Primary Examiner
Art Unit 2814

LP